OPINION PIECE

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Gold, green, and black open access

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Key points

- The debate about open access has until now focused on the gold (journals) versus the green route (manuscript self-archival).
- Recently an even more disruptive form of OA has emerged, in the form of illegal article copies retrievable from academic social networks or pirate sites.
- Illegal, or "black open access", provides access to a large part of the pay-walled article output which cannot be found in repositories.

INTRODUCTION

Universal open access (OA) to scholarly research publications is deceptively simple as a concept. Any scientific publications, whether found via a Google keyword search, or by trying to access a citation would be just one click away. But the path to get there from the current subscription-dominated journal publishing model has proved to be complex and filled with obstacles. Since the terms gold and green OA were coined almost 15 years ago, much of the debate inside the OA movement has been focused on the relative merits of these two paths (Harnad *et al.*, 2004).

Currently gold OA seems to be growing in importance. There are a number of factors contributing to this. First is the emergence of successful professional OA publishers and megajournals offering rapid publication via an innovative peer review approach. The second coming from hybrid OA publication, is also of increasing impact, fuelled by the new APC funding mechanisms put in place by major research funders like the Wellcome Trust and the Research Councils UK. New kinds of nationwide super-bundle licences that cover both subscription access and hybrid charges, could further establish hybrid as a conversion vehicle to full OA (Björk, 2016).

Traditional green OA in institutional repositories has been struggling with getting researchers to upload, despite the fact that most major universities now have such repositories in place (Eisen, 2015). The researchers just do not seem to bother with the little extra work involved and many are ignorant of the possibilities. The leading subject repositories, arXiv and PMC are doing better, but only cover some fields of science. And publishers have tightened embargo rules for self-archiving, making green OA less attractive.

All in all, the progress towards full OA has been slower than hoped for. Currently somewhere between 35 and 50% of all research articles from recent years can be found as either gold, hybrid, or self-archived repository copies. Empirical studies have shown varying shares depending on the definitions and methods employed (Archambault *et al.*, 2013; Björk, Laakso, Welling, & Paetau, 2014; Research Information Network, 2015).

A recent development muddling the picture is the emergence of other channels for uploading and accessing research articles without subscriptions, payments, and bureaucracy. In contrast to proper repositories which by and large enforce the licence rules, these new channels mostly offer the exact digital replicas of the published journal articles, and do so illegally. The two main players are academic social media, especially Research Gate, and pirate copy websites such as Sci-Hub. I propose to call this black OA. Black as in the classical pirate flag, or in black market! I was first considering the milder colour grey, but the term grey literature has already an established meaning in the context of scholarly publishing covering theses, government reports, and the rest (Schöpfel, 2011). Grey literature has in fact greatly benefitted from OA. Other terms which have been suggested are 'rogue' OA or 'Robin Hood' OA (Archambault, 2014), but my preference is for a simple tricolour scheme. In terms of colour coding of flavours of OA the term platinum OA (Haschak, 2007) has also been proposed for non-APC-charging gold OA (free also for authors), but the term has never really caught on.

ACADEMIC SOCIAL NETWORKS

Academic Social Networks (ASNs, i.e. Research Gate, Mendeley, Academia.edu) have their origin in the tremendous success of

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networks like Facebook and LinkedIn. Like all such networks, the key factor is critical mass. If enough colleagues of yours have already joined, the incentive increases. Some ASNs also have a dubious practice of spamming non-members with emails seemingly coming from colleagues, which actually are sent automatically by the systems. ASNs also try to offer other features like citation counts of their own, user profiles, and so on (Nicholas, Clark, & Herman, 2016).

The leading ASNs are all business ventures where the revenue model, because they do not charge members, is to build up a big enough user base to exit via being bought by a bigger company (Matthews, 2016). The prime case is Mendeley, which was purchased by Elsevier in 2013. Elsevier also bought the much older SSRN (Social Sciences Research Network) in 2016.

Although most articles uploaded to ASNs are direct portable document format (PDF) copies of the published articles, it is perfectly possible to upload personal versions of the manuscripts. But even this might not be in accordance with many licence agreements that authors have signed with publishers.

So far massive lawsuits against ASNs have not started, but for instance Elsevier has sent out takedown requests to Academia.edu (Howard, 2013).

PIRATE COPY SITES

The role model for sites of pirate copies of scholarly journal articles is Napster. Here the driving force is not financial gain but indignation that a few big publishers are making big profits 'off the back' of the global academic community. The notion that the results of research is a public good which should be free is common with advocates of gold and green OA, but the approach is more radical in actually breaking the law. To date Sci-Hub is the notable example, although there have been earlier incidents of massive downloading of scholarly articles by OA activists (Murphy, 2011). Another related way of obtaining article copies is to twitter messages including an article title (i.e. #icanhazPDF) asking unknown academics who have subscription access to download a copy and mail it to the tweeter (Gardner & Gardner, 2015).

As blatantly illegal as Sci-Hub for instance is, it has been difficult for the publishers to take legal action. What they have achieved so far is that Sci-Hub has been forced to cede some domain names, but the service has so far managed to quickly resurface using slightly altered ones (Kravets, 2016). As for approaches like #icanhazPDF, although the actions are in principle illegal, it would be extremely difficult to take legal action.

WHY HAS BLACK OA BECOME SO POPULAR

Black OA has grown very rapidly in the last 3–4 years. The reasons are slightly different for the two subspecies. Authors who have joined ASNs probably find it easy to just post the exact published PDF of their article there, no questions asked. The alternative, using their institutional repository, would entail first finding out the exact meaning of the complex copyright and licence agreements they sign with the publisher. After that there would often be the extra work of formatting the manuscript, inserting a title page, and reformatting for instance tables and figures which often have been separate files before submission.

From the reader's viewpoint ASN copies are as easily findable as other types of green OA. In a Google scholar search a free Research Gate copy will show up in a column to the right, the same way an institutional or subject repository one will. A basic Google search will primarily point to the publisher's version, usually behind a pay wall. But simply adding 'Research Gate' to the title in the search string will take you to the copy, if there is one.

As for Sci-Hub it is a pure pirate site, which has not asked for consent from authors or publishers. The repository has downloaded more than 50 million journal articles directly from the publishers' websites (Bohannon, 2016). This has been accomplished using the passwords of individual researchers to their university library portals for mass downloading, but it is unclear if the passwords have been voluntarily given by the individuals in question, or whether they have been obtained by phishing.

Slightly cumbersome for readers is that Sci-Hub copies do not show up in Google or Google Scholar searches. The user has to go to the site itself (which is constantly changing name, due to lawsuits from the big publishers) and input the digital object identifier (DOI) or the title of the article he searches for. In case it cannot be found this actually triggers Sci-Hub software to go and find and retrieve it. Hence the site is used more as a last resort when a free copy cannot be found otherwise. It is definitely quicker than mailing authors in the hope of obtaining a copy, not to mention the archaic and slow method of interlibrary loan, if that is even a possibility. And for many younger academics and students paying pay-per-view charges is out of the question. The strength of Sci-Hub is currently that it is much more comprehensive than ASNs or repositories which only contain selected articles rather randomly. And many of the users of Sci-Hub, despite this, say they use it more for convenience than to save cost (Charleston Conference, 2016).

In summary, for both ASNs and pirate sites there are three major reasons why they have become so popular with both authors and readers. Ease of use, the fact that they are found morally acceptable by most academics (Travis, 2016) and the almost non-existent legal risks involved in up- and downloading individual articles.

CONCLUSIONS

In a nutshell, around 25% of recent research articles (after a year) are accessible as gold OA, and an additional 15–20% can be found as legal green copies. Of the remaining 50% the vast majority are findable as illegal black OA copies.

The direct negative effects of black OA on mainstream subscription publishing, in terms of decreasing revenue, have so far probably been negligible. A major reason is that most of the sales

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revenue is in the form of huge electronic big deals, which usually span several years. Also the publishers exert huge lock-in power, so that it is almost impossible for a library to refuse a deal with one of the major publishers. There is thus a lot of inertia in the system, isolating it from negative impacts of both green and black OA. The loss of income could potentially be bigger in less-developed countries with strained university budgets, but publishers get much less income from those anyway and in many cases offer free access.

The biggest effect of black OA could in fact be in diluting the popularity of green OA channels, in combination with publishers tightening the embargo rules, which in institutional repositories tend to follow.

If anything, black OA should be seen as a symptom of a seriously flawed mainstream scholarly publishing model, which has failed to adequately adapt to the needs of the international research community. Black OA is obviously not a solution to the problems, the remedy is (in my opinion) 100% gold OA for research papers funded by APCs or other mechanisms. If and when we get there the 'market demand' for retrieval via sites like Research Gate and Sci-Hub will disappear, and the use of subject and institutional repositories will be reduced to preprint manuscripts, grey literature, and overlay purposes.

ACKNOWLEDGEMENTS

On a personal note I have a wide-ranging experience of the channels discussed in this article. I have published in both free and APC-charging OA journals, in a delayed OA journal, and some articles of mine in subscription journals are hybrid OA. I have uploaded many manuscript copies to my university's institutional repository, to a personal website shared with a colleague, and some of my articles can be found in PMC. Co-authors have uploaded articles to Research Gate, and the one subscription journal article I specifically checked via Sci-Hub was indeed retrievable.

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